

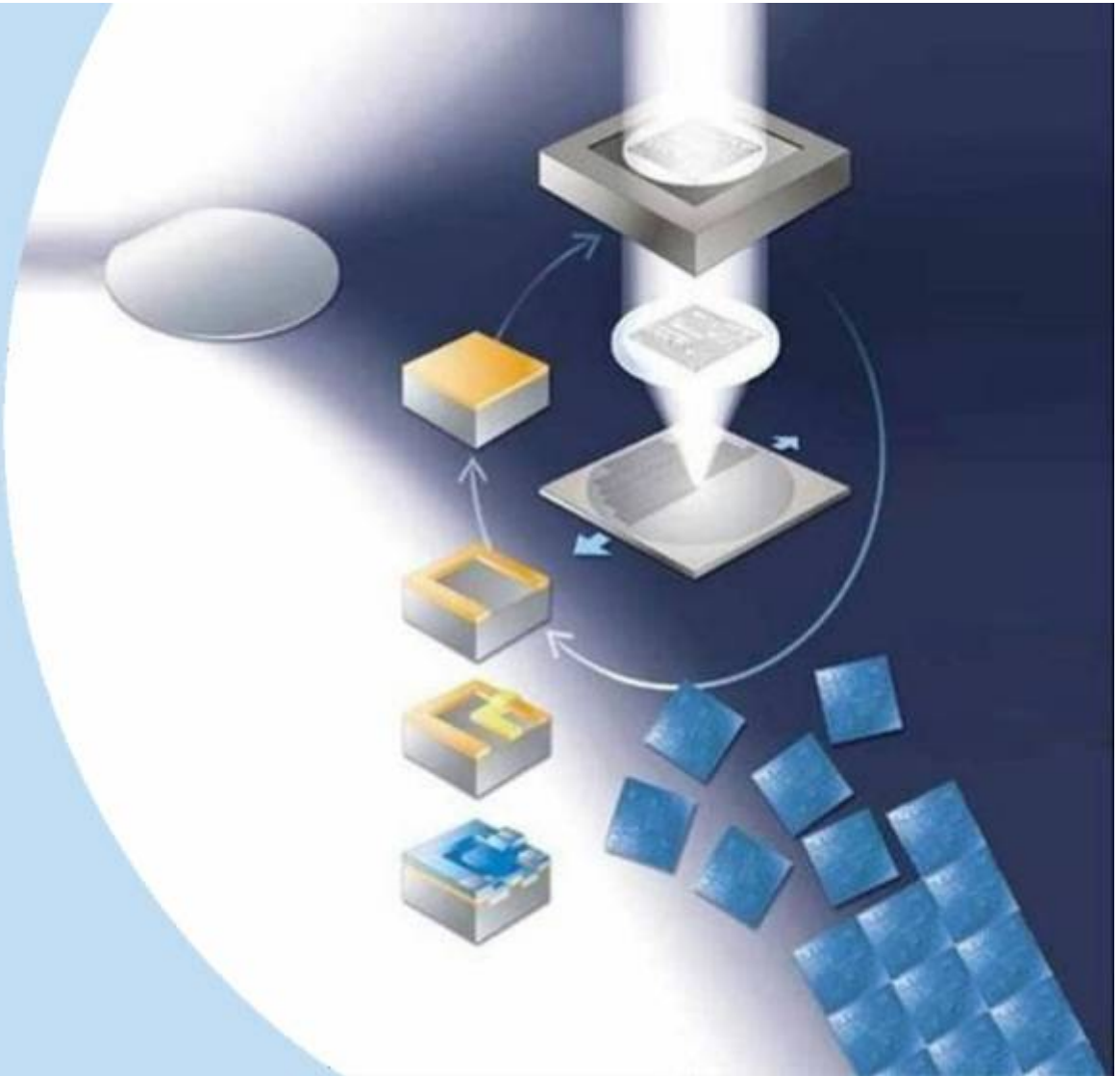
Optics for EUV Production



NXE 3100

NXE 3300

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Agenda



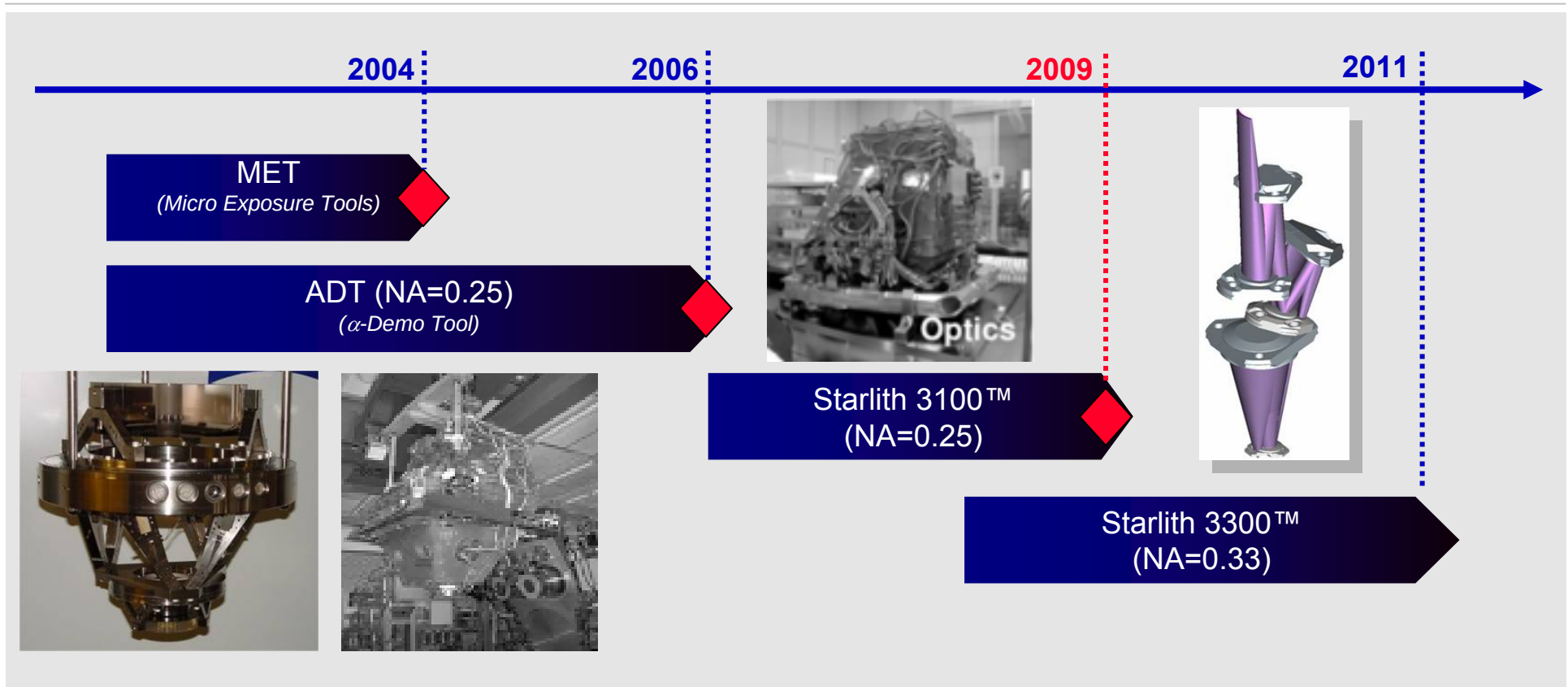
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|---|--------------------------|
| 1 | Introduction |
| 2 | 3100 Update |
| 3 | 3300 Illumination System |
| 4 | 3300 Projection Optics |
| 5 | Summary |

Agenda



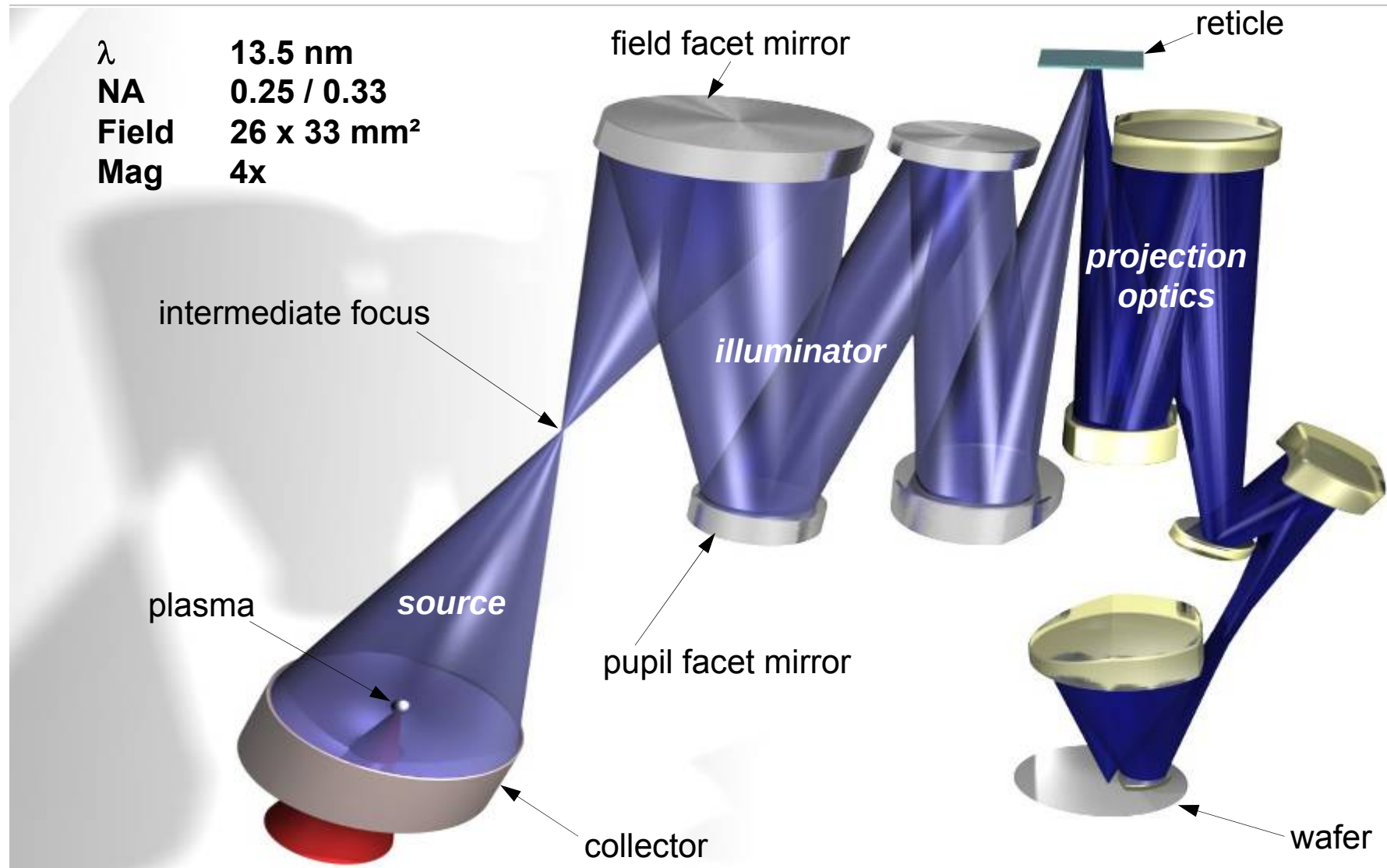
1	Introduction
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EUV program at Carl Zeiss SMT GmbH



- Strong commitment to EUV technology: a continuous EUV development program is established since more than 15 years at Carl Zeiss

The optical train – Introduction



Agenda

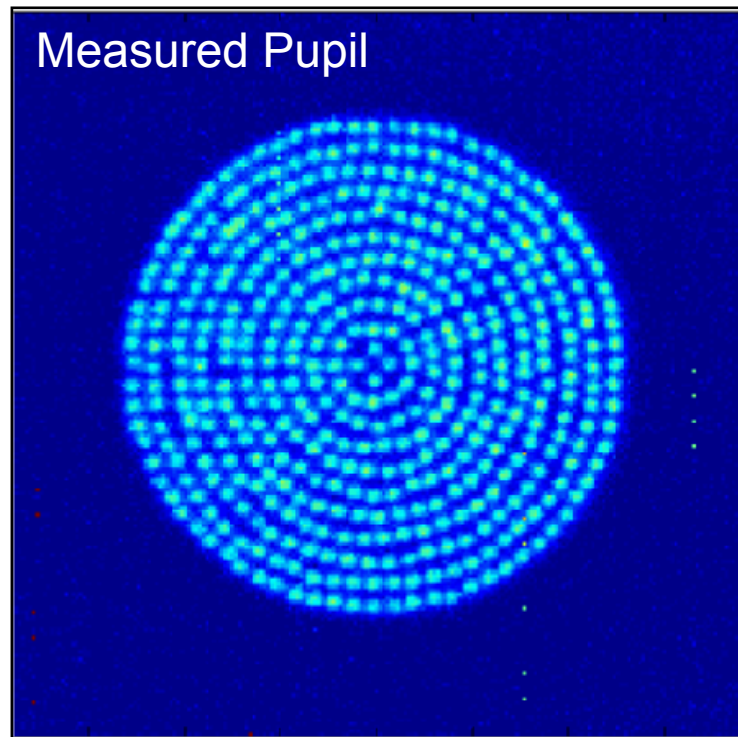


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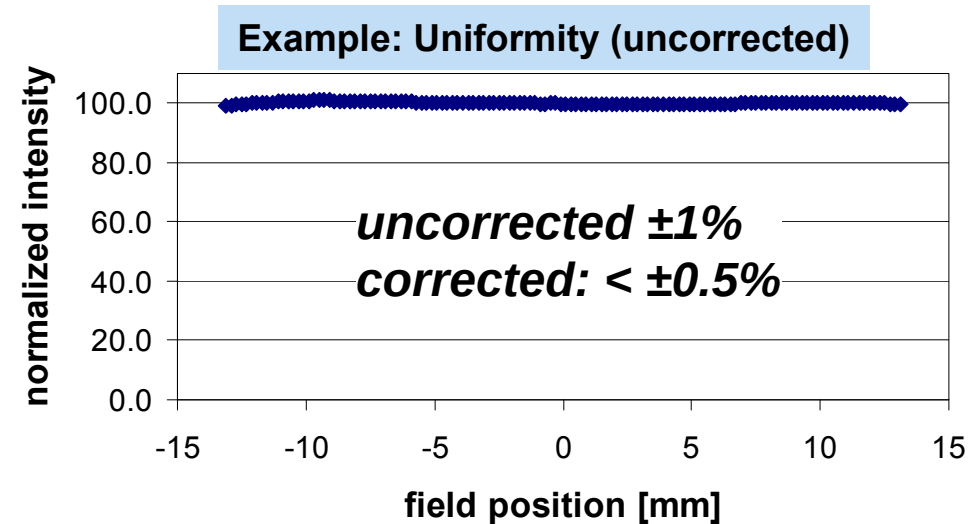
NXE 3100 – Six complete systems shipped to ASML



NXE 3100 – Six illumination systems qualified

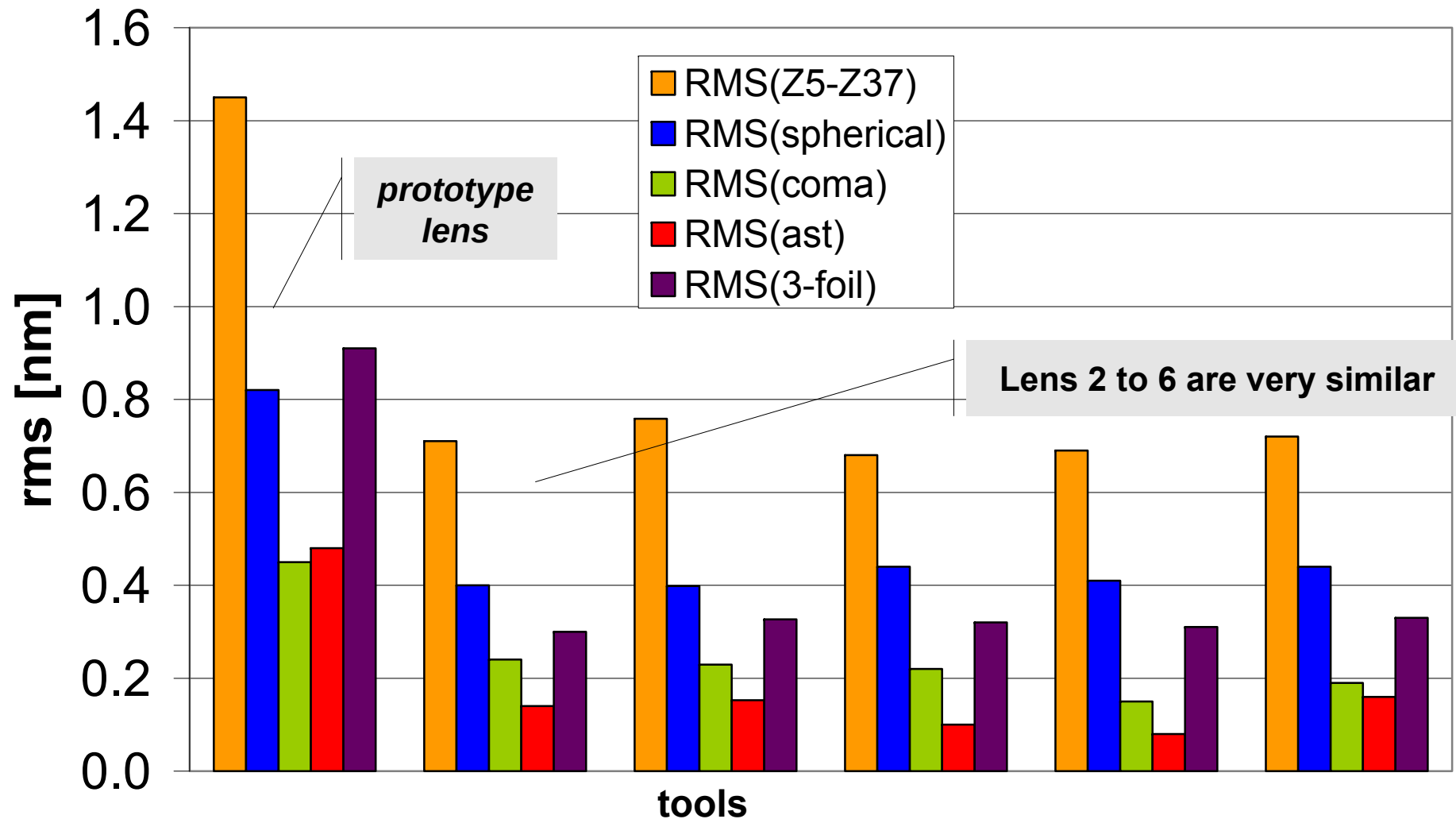


Parameter	
Transmission	✓
Uniformity (un-corrected)	✓
Telecentricity [Tx/Ty] (wafer level)	✓
Ellipticity [E90/E45]	✓

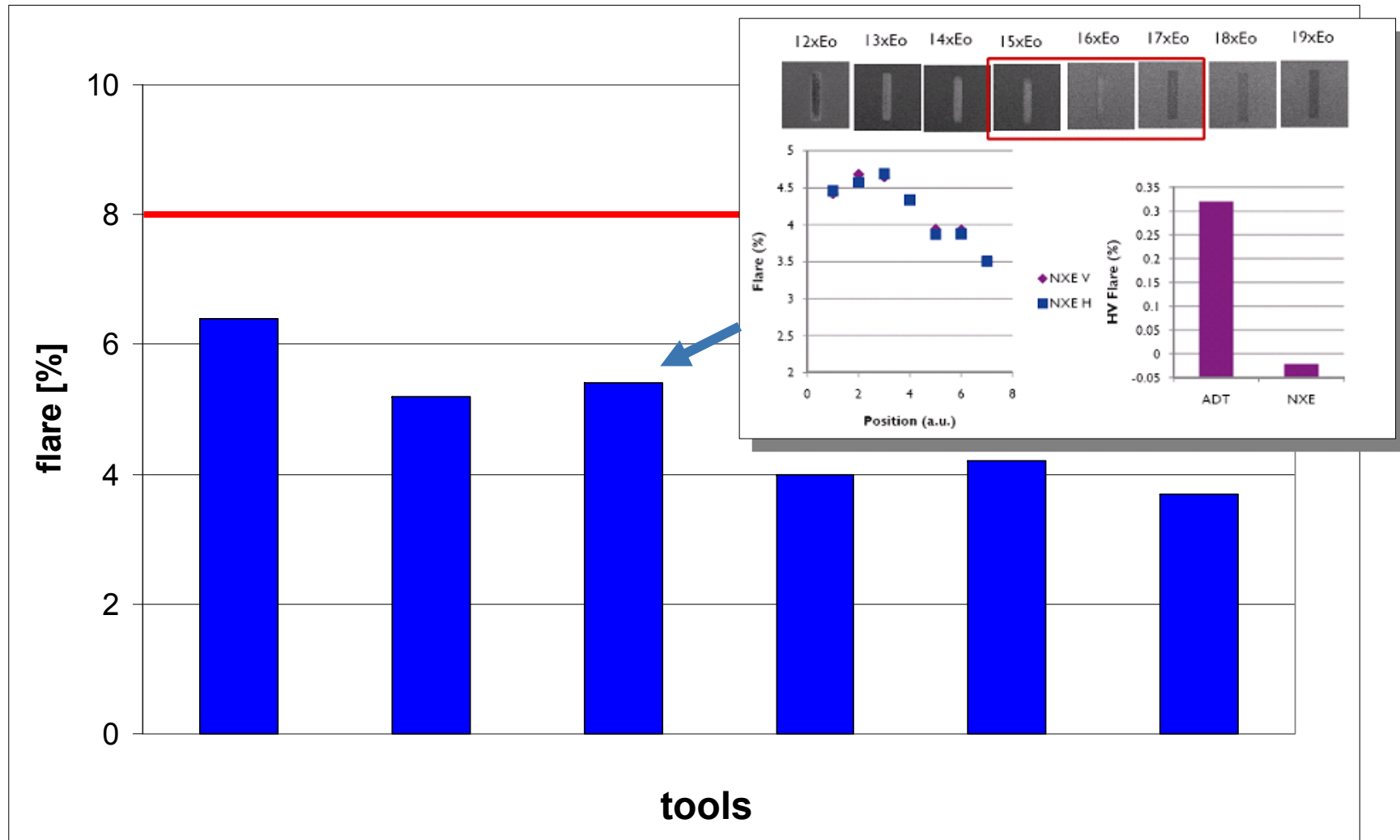


NXE 3100 – Six projection optics qualified

wave front aberrations



NXE 3100 – Flare is well in Specification for all delivered systems



Agenda

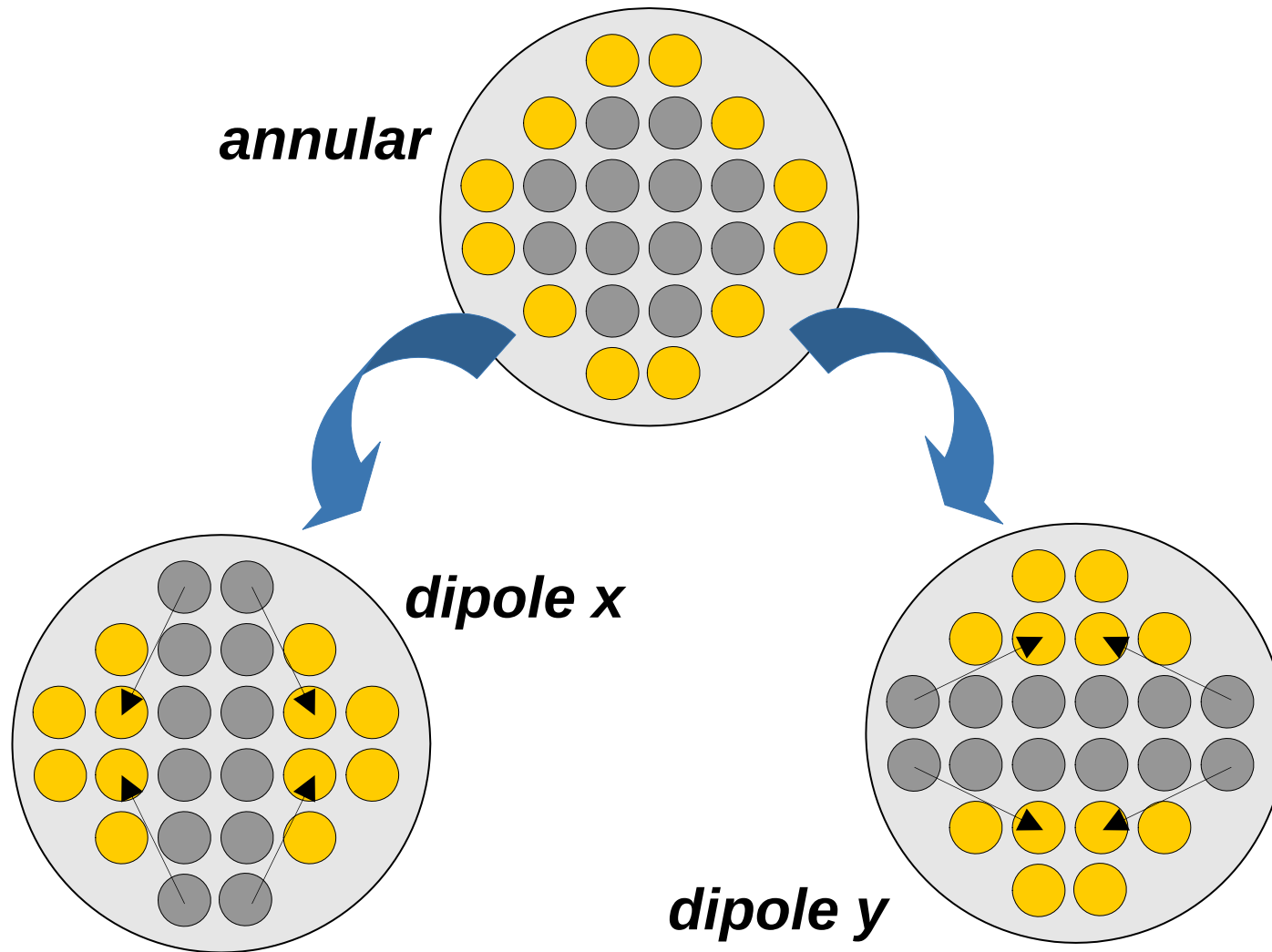


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NXE 3300 - Prequalification Illuminator already shipped to ASML



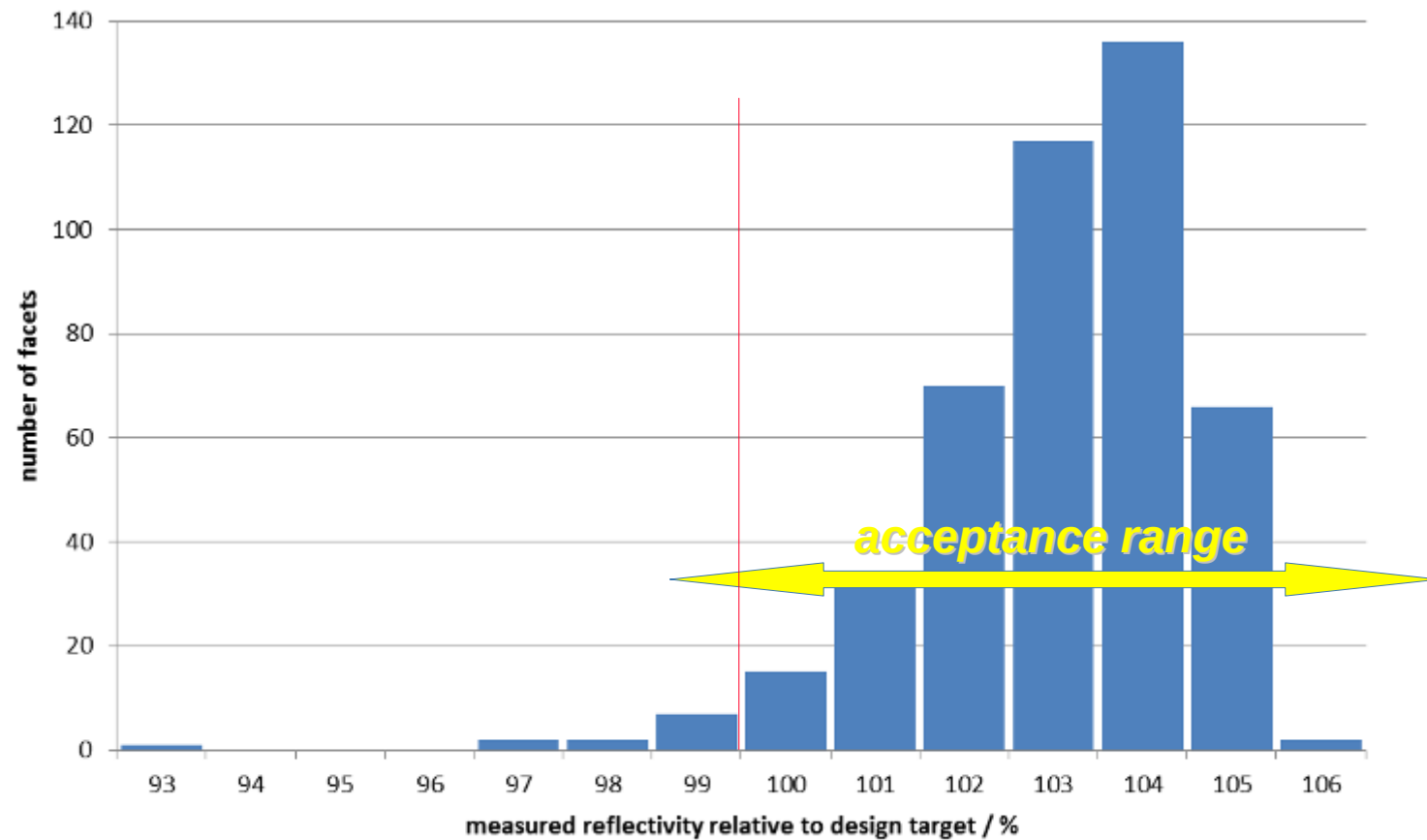
NXE 3300 - Off-axis illumination enables lossless setting changes



NXE 3300 - Facet Performance - PF Reflectivity



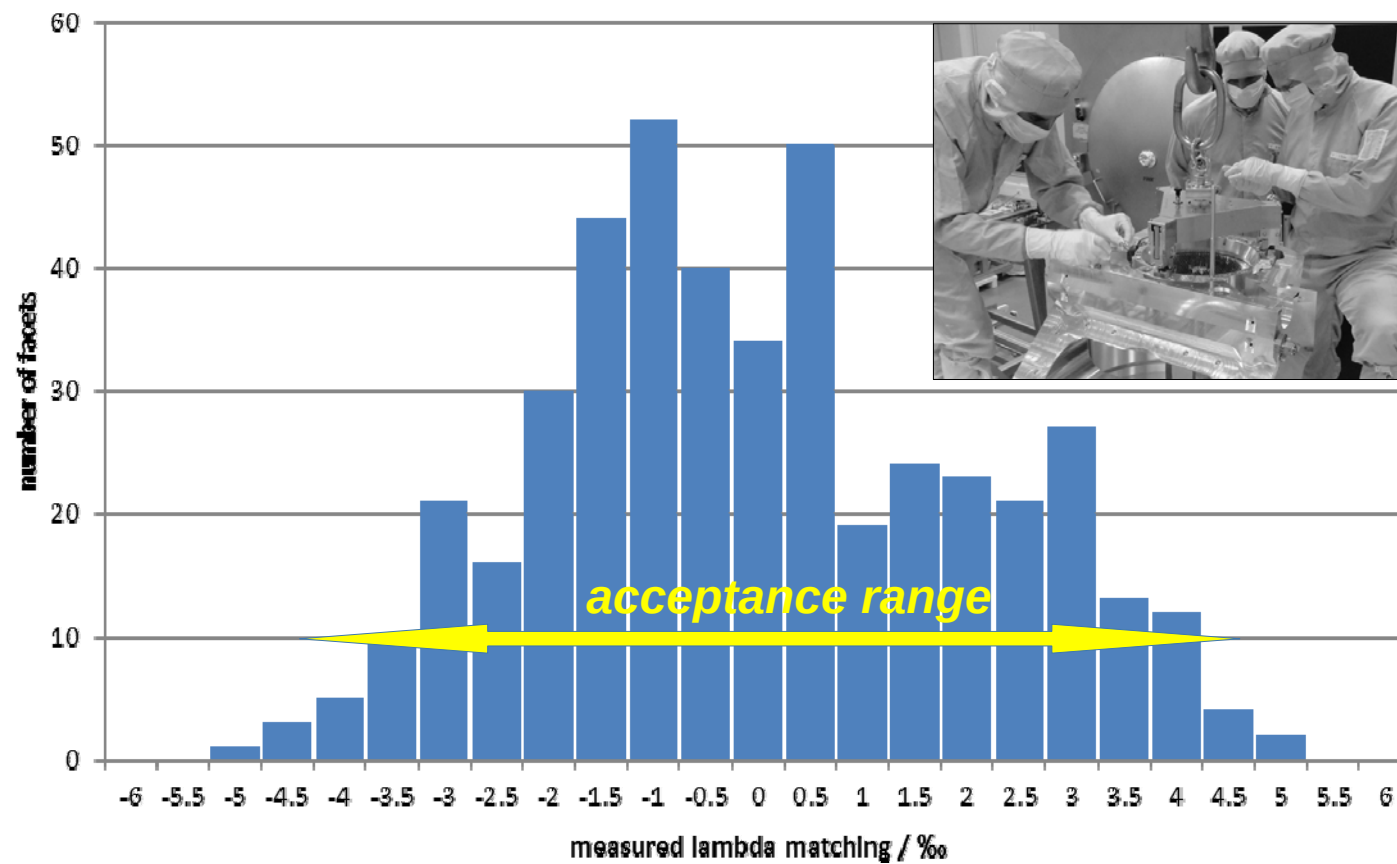
Mean reflectivity of pupil facets is well above design target.



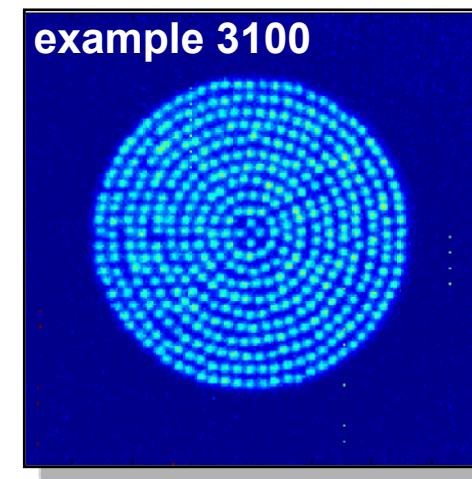
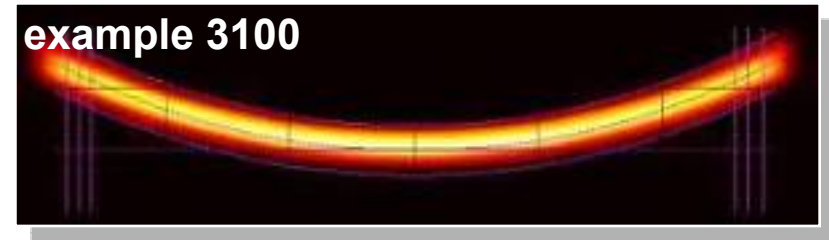
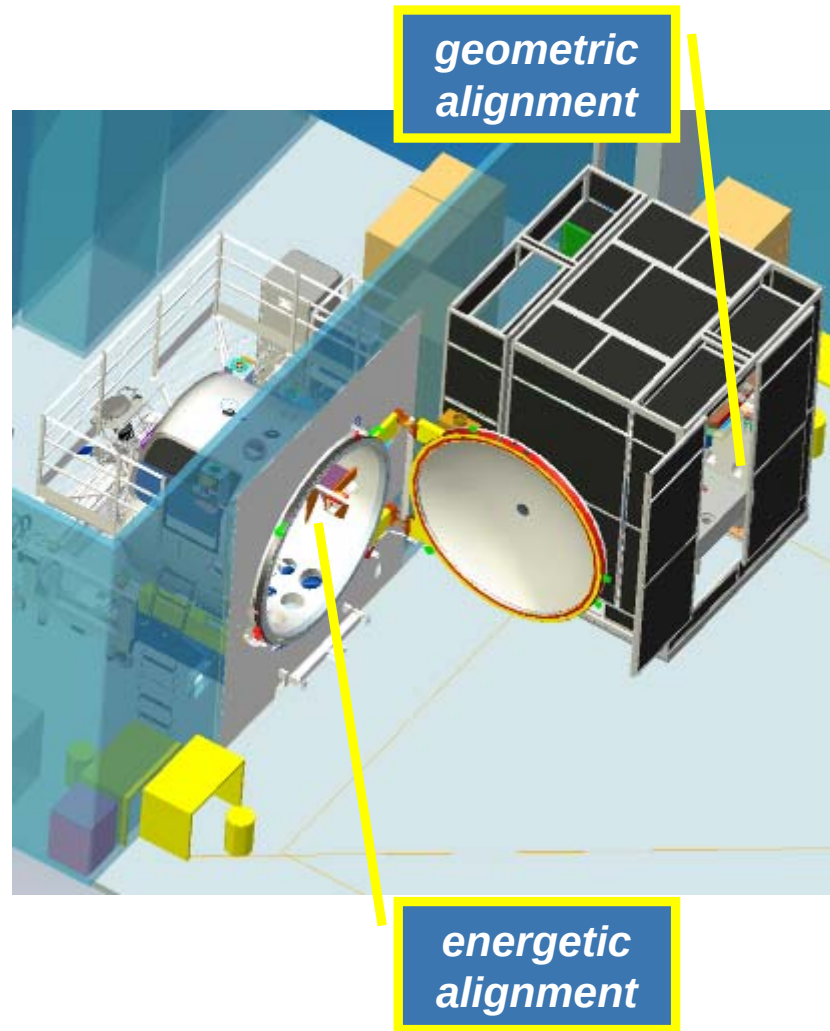
NXE 3300 - Facet Performance - PF Reflectivity



Peak wavelength is well centered around design target.



Illuminator qualification – split up in geometric and energetic alignment ...



... and are ready for qualification



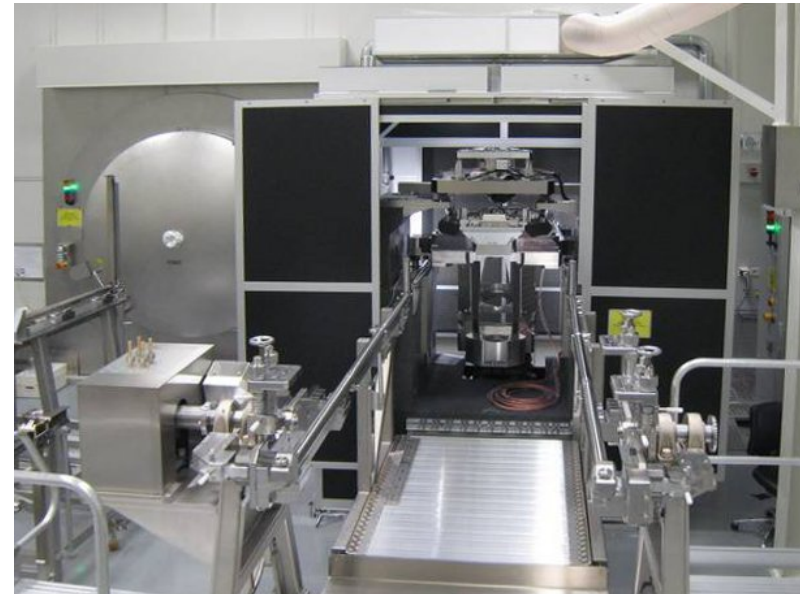
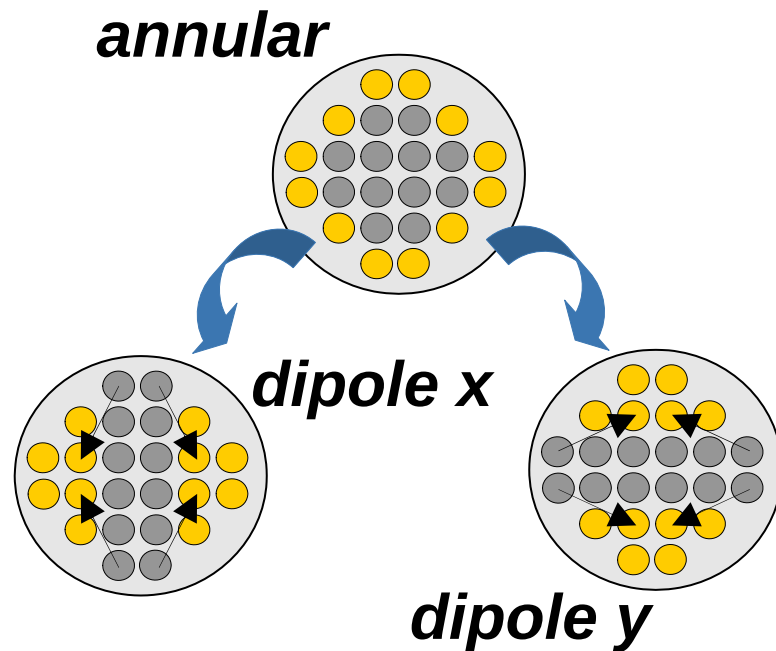
EUV qualification
chamber



visible metrology cabin

*ready for illuminator
qualification*

NXE 3300 - Functional tests on first illuminator with a limited number of field facets



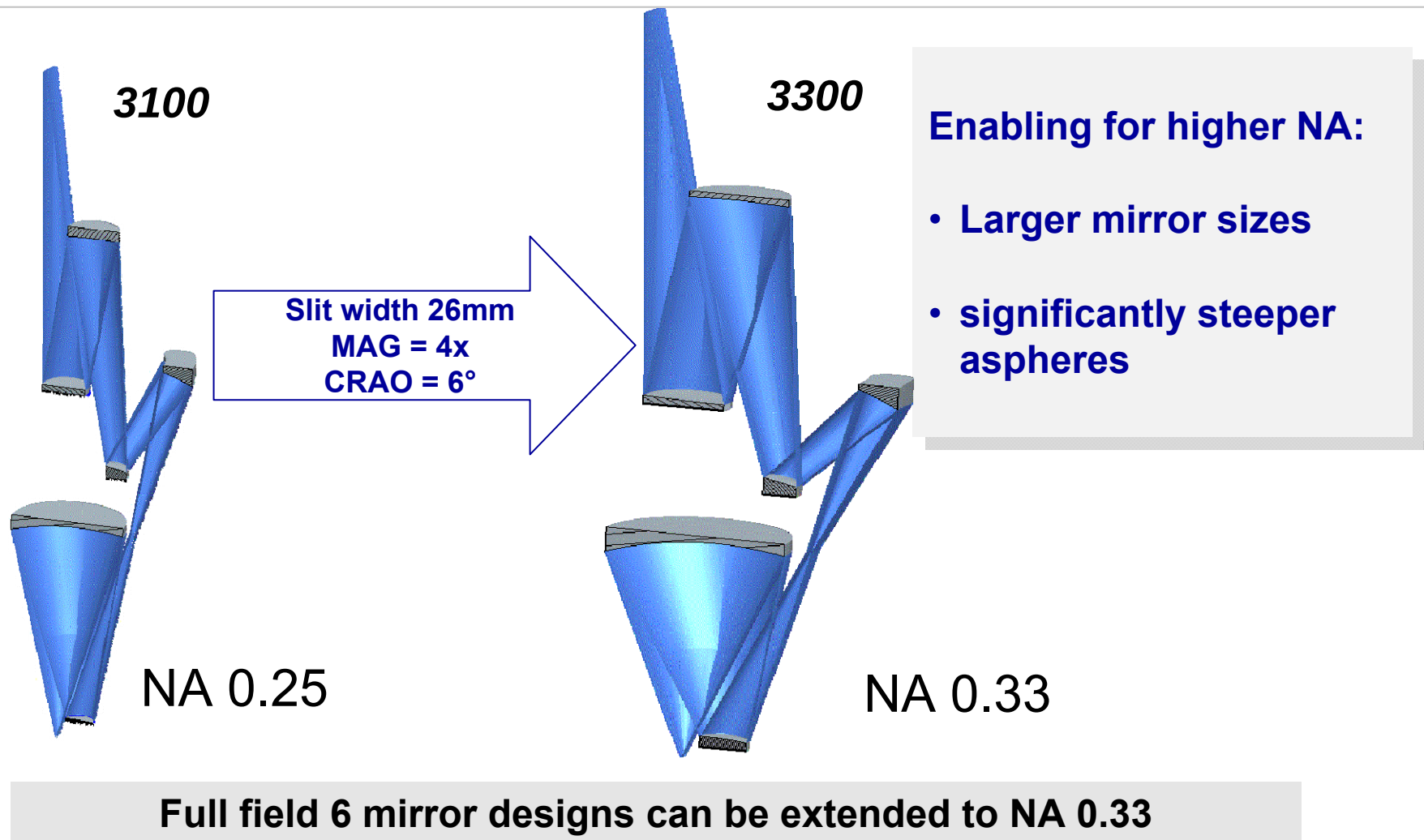
First switching of field facets as functional test of illuminator

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NXE 3300 – Projection optics design for NA 0.33



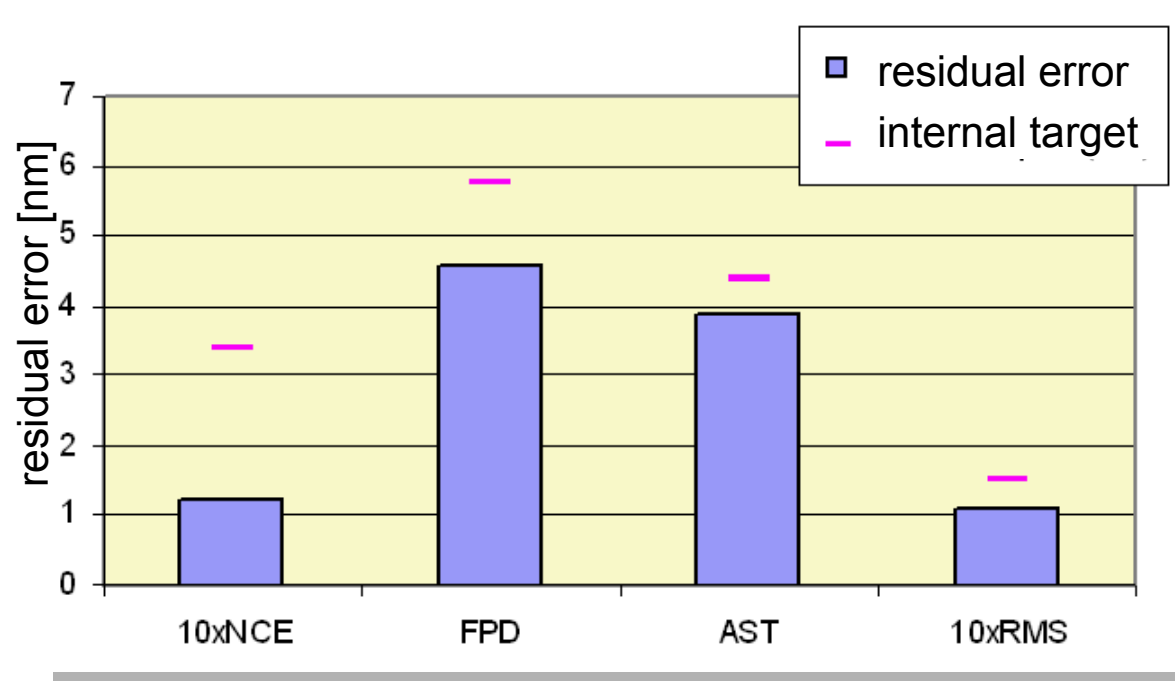
schematic designs – for illustration only.

NXE 3300 – Projection Optics

Surface figure in Specification



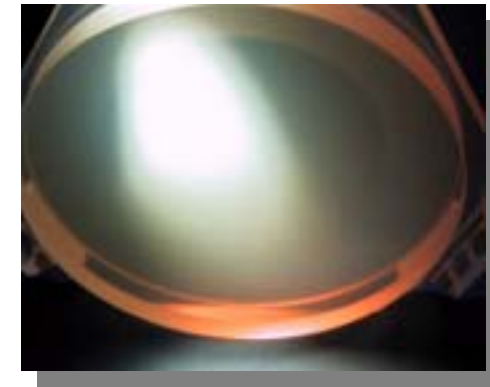
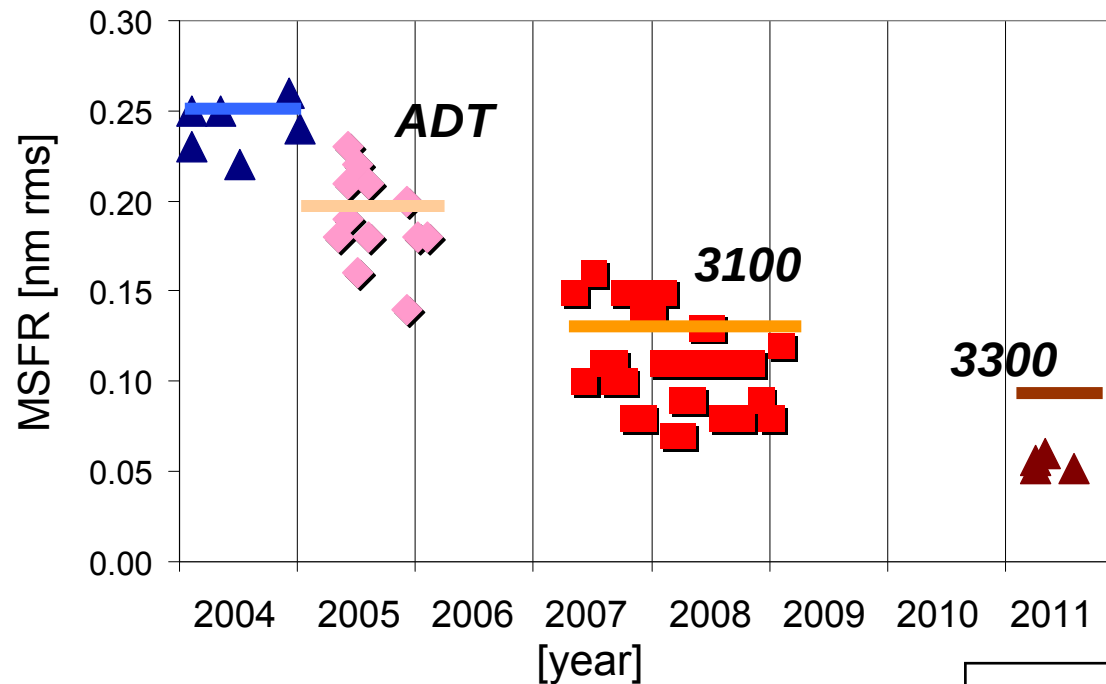
achieved surface quality
rms = 0.1 nm



NXE 3300 – Projection Optics

First mirrors are well in flare specification ...

... and more than 60 mirrors in production !

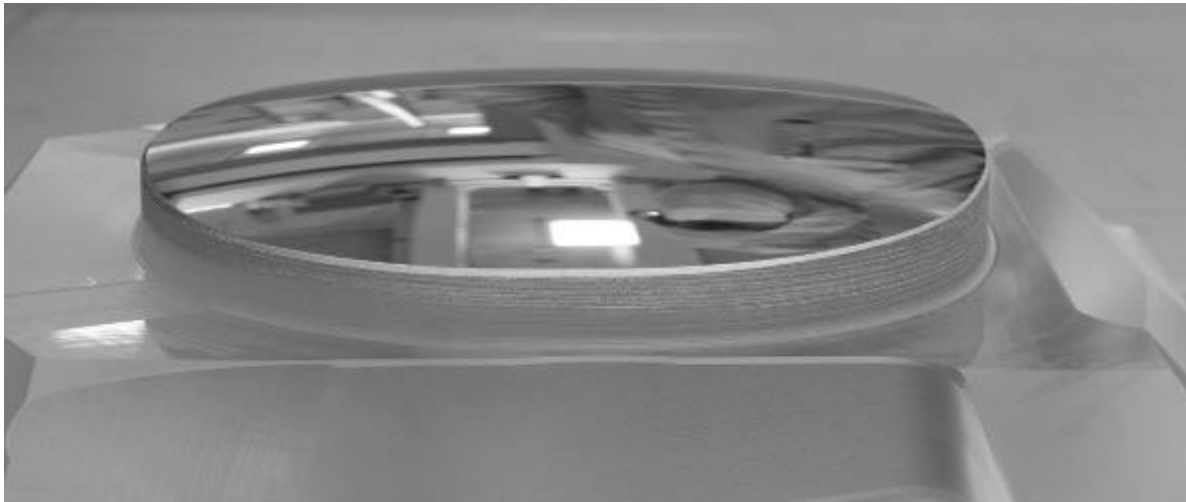


	3100 average	3100 Champion	First 3300 mirrors
MSFR	102 pm	59 pm	78 pm 52 pm

First results on 3300 mirrors well below the 6% flare Specification - 4% (below a 2 μ m line) can be expected

NXE 3300 – Projection Optics

Coating Results of first POB mirrors



Wavelength matching:

$\Delta\lambda$: 0,2% (target: $\leq 0.2\%$)

Reflectivity:

R: target + 1.2%

Homogeneity

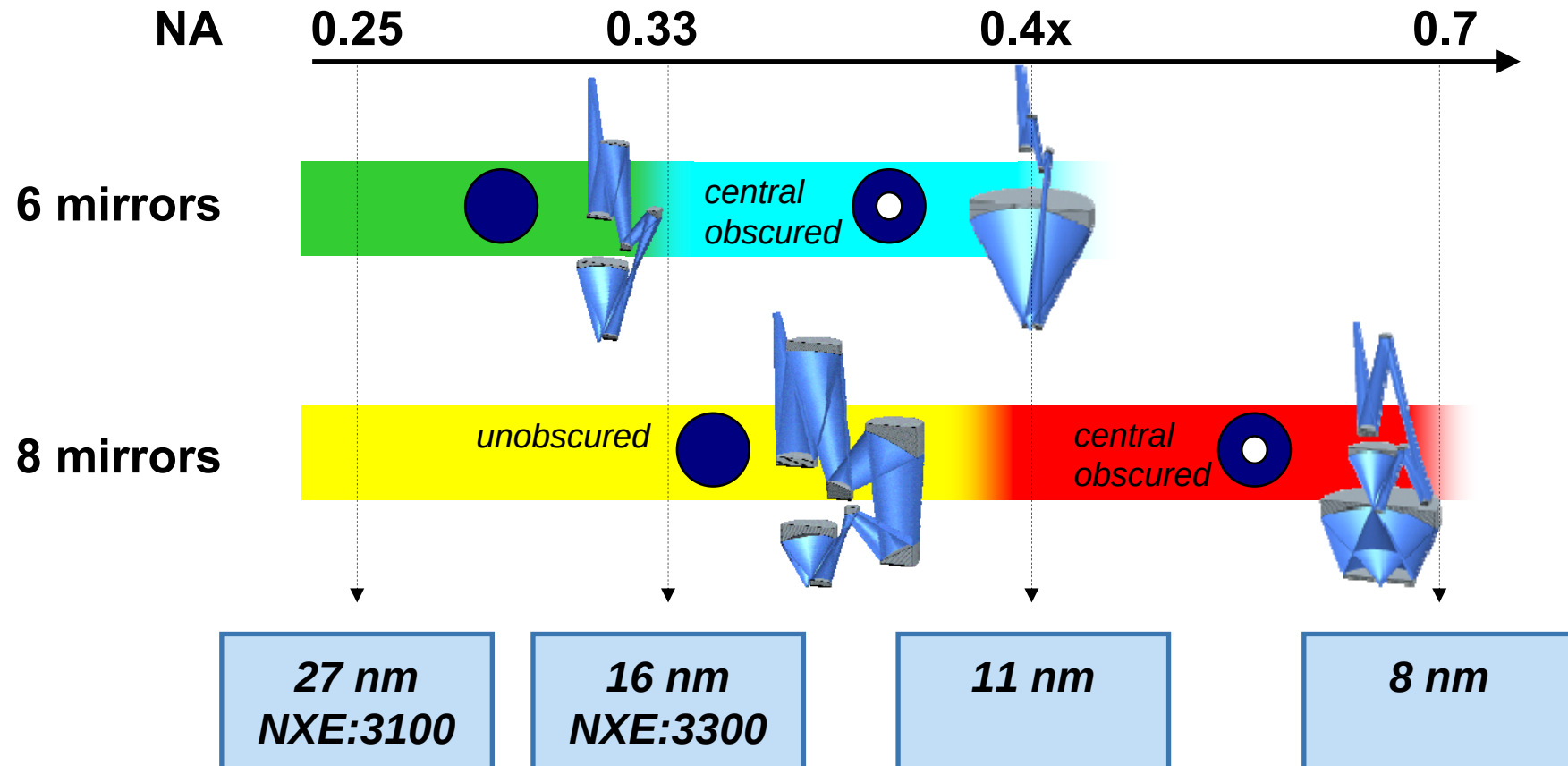
$\Delta R_{\max}$: 0.28% @ 5°
(target. $\leq 0.4\%$)

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We see design solutions for high NA systems enabling 11 nm resolution and beyond



schematic designs – for illustration only.

1 NXE 3100 Program

- **six systems are delivered to ASML**
- **all key performance parameter are within specification**
- **optics fulfills requirements for 27 nm hp and enables R&D for the 22 nm node**

2 NXE 3300 Projection Optics

- **more than 60 mirrors in production**
- **4% flare expected based on current mirror quality**
- **first mirrors successfully coated**

3 NXE 3300 Illumination System

- **pre-qualification Illuminator already shipped to ASML**
- **metrology tools ready for qualification of first system**
- **first tests on flexible fly's eye successful**

Thanks

to the EUV teams at ASML and Carl Zeiss SMT and our partners

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“EXEPT”)



We make it visible.